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ABSTRACT

To determine the effect of verbalization on the acquisition of manipulative skills in young children, a puzzle-assembly experiment was designed. Each of 65 Head Start children between the ages of 47 and 58 months was randomly assigned to one of the four treatment groups: practice with verbalization (PV); practice with no verbalization (PNV); verbalization with no practice (VNP); and a control group. All children were pretested on the Peabody Picture Vocabulary Test, Goodenough Draw-a-Man Test, a simple puzzle assembly, the specific vocabulary from the task, and progressively more difficult puzzles. The PV group was taught puzzle assembly with a carefully sequenced program of puzzles and related vocabulary. The PNV group spent equal time with the same puzzles, but were not taught vocabulary. The VNP group read books that emphasized the special vocabulary but were not given puzzles. The control group spent an equal amount of time on a neutral task. PV and PNV groups showed high interest and similar, significant gains in puzzle-assembly skills. The VNP groups, however, regressed in performance and showed little interest. Verbalization and practice manipulation seemed to be important elements in improving puzzle-assembly skills. (MH)

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EFFECT OF VERBALIZATION ON YOUNG CHILDREN'S LEARNING OF A MANIPULATIVE SKILL[1]

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While the value of verbalization has been investigated in young children's concept learning, little has been done to determine the effect of this variable on the acquisition of manipulative skills.

A common manipulative motor task for preschool children is the assembling of jigsaw puzzles. Jigsaw puzzles are generally included in listings of standard equipment for good curricula in preschool classes. Some of the values attributed to the use of puzzles for young children include the opportunity for practice in eye-hand coordination, use of small muscles, recognition of shape and color, and use of visual memory (Hammond, 1963).

Since puzzle assembly is assumed to have a relationship to basic sensorimotor development, a study of how verbalization affects the preschool child's learning to assemble puzzles could yield information on the relationship between verbalization and the acquisition of motor skills.

Motor proficiency and measures of verbal intelligence have been found to be related in young children (Sloan, 1951; Francis & Rarick, 1959; Whipple and Maier, 1966), but Hodges and Spiker (1967, p. 37) suggest a dearth of studies on motor characteristics of disadvantaged children of different

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levels of intelligence. This, they say, makes it "impossible at this time to determine whether poorly developed motor skills are a function of intellectual subnormality, cultural impoverishment, or some combinations of both."

In a recent study, Rieber (1968) found that "motor skills are learned in a gradual manner unless the task provides cues which can be incorporated in mediational chains" (p. 567). The cues he provided were non-verbal. Since language, when internalized by the young child, may act as a mediator in his actions and thoughts, (Bruner, 1961; Luria, 1957) verbal cues might further accelerate learning motor skills. Appropriate verbal labels, when thoroughly learned, were found to facilitate concept identification (Stern, 1964; Spiker, 1963; Shepard, 1956; Tittle, 1965) and problem solving in young children (Kendler and Kendler, 1964).

The hypothesis that verbalization will serve a facilitating mediational function when presented along with puzzle assembly practice was tested with 65 Head Start children randomly assigned to one of four treatments: practice with verbalization (PV); practice with no verbalization (PNV); verbalization with no practice (VNP); and a control (C) given equal time with a neutral experience.

Method

Subjects

All the children between 47-58 months (mean age 55 months) in three Los Angeles Head Start centers participated. The centers were located within a 10 block area and were under the auspices of one delegate agency, and had the same child development supervisor.

Materials

Twenty 9" X 11" fiberboard puzzles were used. Three of these were made by commercial firms; the remainder were designed and constructed for the

experiment. They ranged in difficulty from simple three-piece formboards to designs which included fifteen pieces. Eleven of the instructional puzzles represented geometric forms in abstract designs. They were painted in bright colors-one solid color to a board. For these puzzles, therefore, the shapes and sizes of the pieces were the only cues for their selection.

All the puzzles were presented to the children on trays in specially designed "pop-up" boxes, each of which contained six trays. The box was fitted with springs so that when the top tray was pulled out the next tray, containing the puzzle which was next in the instructional sequence, was automatically raised into working position.

A prepared script was used for the PV treatment. This script stated which visual stimulus materials were to be used, in what order they were to be presented, and how they were to be shown to the child. In addition, it included the verbatim commentary the teacher was to present. For the VNP treatment, 10 children's books were used. Nine were commercial books which incorporated selected concepts of sizes and shapes. Where necessary, the vocabulary was adapted to conform to that used with the PV group. A tenth book, used with both the PV and the VNP groups. contained a story prepared especially for this study.

Procedure

Individual pretests were given to all the children. The pretests included two measures of intelligence (Peabody Picture Vocabulary and Goodenough Draw-a-Man Test) and the following three criterion tests:

1. Formboard. A timed measure of manual dexterity with an easy puzzle assembly task. Pilot work with similar children indicated that the task of placing pieces in a nine-piece formboard was not too difficult since almost all the children were able to do it, given enough time. However, differences in speed of performance were considerable.

2. Vocabulary. A measure of the child's familiarity with the specific terms used in the program. Four levels of competence with shape concepts were measured: (a) labeling; (b) pointing or selection; (c) matching to a model; and (d) identifying shapes in natural settings.

3. Assembly. Six commercial puzzles (Playskool) were selected to test at levels of increasing difficulty. After scanning the picture on the first puzzle with the child, the examiner removed the pieces and asked the child to replace them as fast as possible. If the child was passive, or unsuccessful in placing any piece, the examiner gave a verbal assist. Every fifteen seconds thereafter the examiner, if needed, assisted either by placing a piece in the puzzle (manual assist) or making a suggestion (verbal assist). If the child completed the puzzle within a three-minute period, with or without assistance, he was presented with the next puzzle in the same manner. If he failed to complete the puzzle within three minutes, the examiner completed it with him, allowing the child the satisfaction of putting in as many pieces as possible. No further puzzles were then presented.

Scores for this test were computed by first totaling the time taken, in seconds, and the number of assists required to complete each puzzle, and then subtracting this sum from the maximum deficit score possible for the puzzle. The resulting sum represented the deficit balance for each of the puzzles attempted.

Treatment Groups

Following the pretests, the children were divided into four treatment groups. All the children at one center were designated as the Control (C) Group. Children at the other two centers were randomly assigned to three experimental treatment groups: Practice with Verbalization (PV); Practice with No Verbalization (PNV); and Verbalization with No Practice (VNP). There were thus five children for each treatment in each class.

The PV Group was taught how to assemble puzzles, using a carefully sequenced program of puzzles and related vocabulary. The PNV Group was given equal time with the same carefully sequenced puzzles, but were not taught a special vocabulary. The VNP Group read books which emphasized the special vocabulary but were not given puzzles. The Control Group read stories of general interest, unrelated to the spatial concepts involved in the study. The program was administered by two female teachers trained by the experimenter and employed by the research project. They were not regular teachers from the Head Start class although they both had had experience with this population.

Each experimental group was given nine lessons over a four-week period. The lessons were approximately 15 minutes long and were given to groups of three to five children ever other day. The two teachers took turns at each of the centers. Each teacher thus taught each group in each center an equal number of sessions. To control for fatigue in the children, a staggered system was used in scheduling the training periods.

Since none of the centers could provide adequate space for the training, a large one-ton step-in van was used as a mobile classroom. The van was carpeted, lighted and air-conditioned. At each center, the van was parked as close to the classroom as possible. The children were personally conducted to and from the van by the teacher.

Following training, all the children were posttested on the three criterion tests.

Results

The mean chronological age, in months, of the total group was 54.7, S.D. 4.6. The mean MA's on the Peabody Picture Vocabulary Test and the Goodenough Draw-a-Man Test were 37.3, S.D. 11.1 and 47.2, S.D. 10.2, respectively. A one-way analysis of variance on both these measures indicated only chance differences among the four treatments.

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Means and standard deviations on the criterion measures are presented in Table 1. All treatment groups showed improvement on the Vocabulary test.

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INSERT TABLE 1 ABOUT HERE

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Gains were also noted on the Formboard test, in which all groups except the VNP showed marked decreases in time required for completion. On the Puzzles test the VNP treatment showed inferior performance on the posttest compared to the pretest.

Correlations between the PPVT M.A. and both the Vocabulary and Puzzle pretests were significant at the .01 level. The Formboard pretest measures showed correlations with PPVT M.A. scores significant at the .05 level. Since there appeared to be a reliable correlation between the criterion means and the PPVT, both M.A. and pretest scores were used as covariates to control for initial differences among the treatment groups.

Analyses of covariance on posttest measures showed treatment effects to be significant at the .01 level for the Vocabulary, Formboard, and Puzzles posttests (Table 2). A Newman-Keuls analysis of the differences, using adjusted

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means, showed that the PV treatment scored significantly higher than the other treatments on the Vocabulary test. On the Formboard, both the PNV and the PV treatments scored significantly higher than the VNP treatment ($p < .01$ and .05, respectively). The same was true for the Puzzles posttest, with the PNV treatment doing better than the PV treatment.

Correlations (See Table 3) between posttest scores on the three criterion

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INSERT TABLE 3 ABOUT HERE

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measures differed by treatments. As expected, manual dexterity appeared to be an important subskill in puzzle assembly. The marked relationship between the Formboard and Vocabulary scores, however, may indicate either that (a) verbal labeling is involved in what was assumed to be a primarily non-verbal task, or (b) the task by which vocabulary acquisition was measured actually involved more manual dexterity than had been anticipated.

There seems to be some relationship between the size of the correlations and the amount of the gain. For the PNV group, which showed marked gains on the Formboard and Puzzle tests, there was a strong correlation ($r = -.60$, $p < .05$) between these measures. Major gains for the PV treatment were also made on the measures which showed the strongest relationships. With the VNP group; which generally showed decrement in puzzle assembly performance, those who did do well on this test are also the ones who learned most on the subskills involved.

Discussion

Both the PV and the PNV treatments showed significant gains in puzzle-assembly skills after the experimental training, while the VNP, which received practice in verbalization but not in puzzle-assembly, regressed on both the performance measures. (See Figure 1.) Whereas the children in the other

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experimental treatments were eager to participate in the daily lessons, the children in the stories group lost interest after the first few days and had to be coaxed and cajoled into coming to the story sessions. In spite of the fact that the stories presented were specifically designed for use with preschool children, these children paid only intermittent attention, would not respond to the questions in the stories, and when they did respond, they frequently pointed to an irrelevant part of the illustration, or simply echoed the teacher's words with no apparent comprehension.

These findings are consistent with those of Almy (1966) who found that pictures or demonstrations are less meaningful to the young child than his own manipulations and experience. Evidently, a procedure which consists of listening to stories and looking at pictures does not keep these children sufficiently involved so that they will put out the effort required in the manipulative tasks. Thus, while the findings clearly indicate that Head Start children can be taught more efficient puzzle assembly skills, they also support the hypothesis that the instructional procedures used appear to be a critical factor in acquisition of puzzle-assembly skill.

Contrary to expectation, the children who were given both practice and vocabulary training were not superior to the children given puzzle assembly practice without vocabulary training. While the differences were not statistically significant, the latter group, which spent all its time on the assembly activity and none on verbalization, proved to be somewhat better on the task with which they had had the greatest amount of practice. However, the group which had had experience in verbalizing the appropriate vocabulary proved to be significantly superior on the vocabulary test compared to all the other treatments.

The lack of significant difference between the performance of the PV and the PNV groups on puzzle assembly seems to indicate, in line with the work of Kendler, 1963 and Cantor, 1965, that the verbal labels, following as they did the completed response, were not as facilitative as they might have been if the verbalization had been required before the child made a selection. Kendler and Kendler (1966) and Rosenbaum (1967) have demonstrated that verbal cues are just as apt to interfere with as to facilitate learning, depending on their location in the programed sequence.

While verbalization did not produce the expected effect with the Practice groups, scores on the vocabulary test showed a significant positive correlation ($p < .05$) for all except the PNV treatments. The relationship between Vocabulary and Puzzle-assembly posttest scores seems to confirm Spiker's (1963) finding that well-learned labels facilitate discrimination learning. The children who learned the labels well, and thus received higher scores on the vocabulary test, were more successful in puzzle assembly. With the Control group, which received neither the opportunity to practice the task nor the associated vocabulary, the children who scored highest on the vocabulary test also tended to do best on puzzle assembly. However, the PNV group, given time on puzzle assembly without practicing the relevant vocabulary, evidently devised strategies independent of vocabulary which enabled them to perform as effectively as the PV group.

In conclusion, dramatic gains in children's ability to verbalize the appropriate concepts as well as to assemble a variety of jigsaw puzzles was demonstrated. Both verbalization and practice were important elements in producing improvement in this primarily manipulative activity.

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TABLE 1

Means and Standard Deviations on Pretest

and Posttest Criterion Measures for All Treatment Groups

		Practice with Verbalization (N=18)	Practice - No Verbalization (N=16)	Verbalization No Practice (N=12)	Control (N=19)
Formboard*					
Pretest	M	50.0	54.6	49.5	54.0
	SD	18.7	24.9	15.2	17.3
Posttest	M	36.5	35.2	53.2	41.1
	SD	11.0	12.5	18.6	17.7
Vocabulary					
Pretest	M	41.1	45.4	41.9	52.8
	SD	6.6	7.7	6.1	8.2
Posttest	M	62.6	49.4	49.5	55.6
	SD	10.5	7.4	14.6	10.4
Puzzles					
Pretest	M	401.7	413.2	437.8	463.8
	SD	158.6	139.6	234.4	124.6
Posttest	M	523.9	555.8	431.7	503.4
	SD	155.5	154.1	114.9	107.2

* These are timed tests: Low scores reflect better performance.

TABLE 2

Analysis of Covariance for Dependent Variables

(with Pretest and M.A. as Covariates)

Variable	Source	d.f.	F
Vocabulary	Treatment	3	7.97**
	$Error_w$	59	
Puzzles	Treatment	3	5.00**
	$Error_w$	59	
Formboard	Treatment	3	5.19**
	$Error_w$	59	

** $p < .01$

TABLE 3

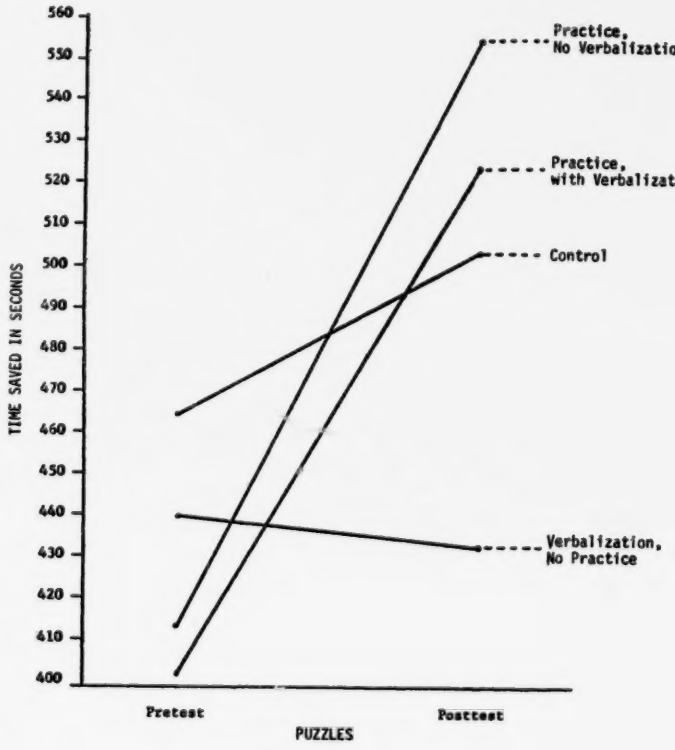
Correlations of Posttest Scores for All Treatments[1]

Test	Practice with Verbalization (N=18)	Practice - No Verbalization (N=16)	Verbalization No Practice (N=12)	Control (N=19)
Formboard with Vocabulary	-.35	-.30	-.57	-.45*
Formboard with Puzzles	-.54*	-.60*	-.54	-.57*
Vocabulary with Puzzles	.53*	.32	.73**	.47*

[1]Negative correlations indicate that performance was directly related for the two measures since the low scores on the measure are indicative of high performance.

* $p < .05$

** $p < .01$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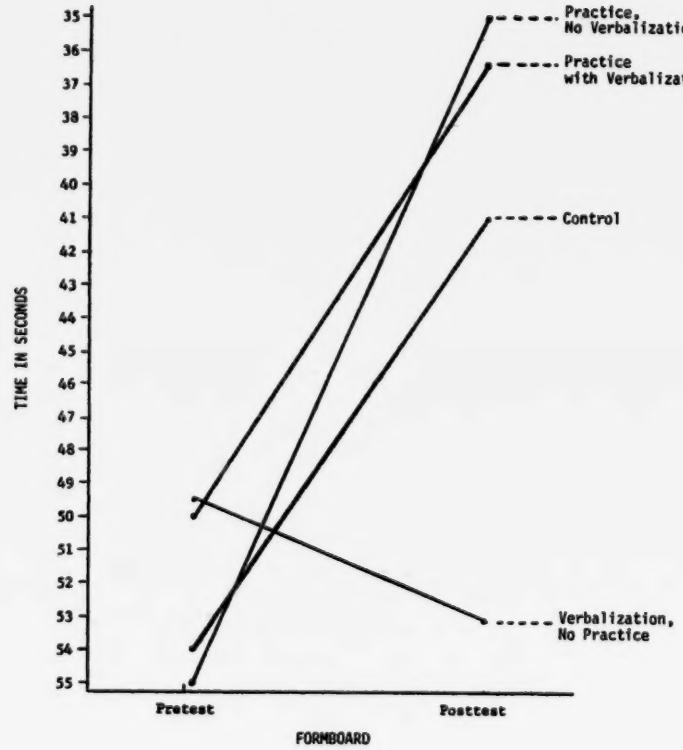
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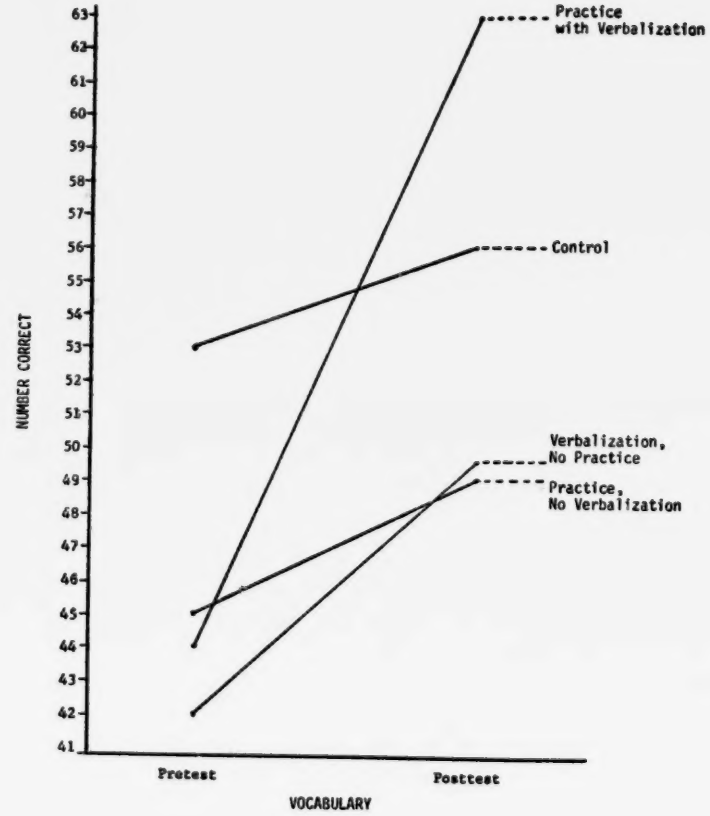
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NUMBER CORRECT
Practice with Verbalization
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VOCABULARY